STATE OF ALASKA

Bill Sheffield, Governor

Annual Performance Report for

INTERIOR ALASKA (TANANA DRAINAGE) NORTHERN PIKE STUDIES

by

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RESEARCH PROJECT SEGMENT

State: Alaska Name: Sport Fish Investigations of Alaska

Project: F-10-1

Study: N-8 Study Title: NORTHERN PIKE

Job: N-8-2 Job Title: Interior Alaska (Tanana Drainage) Northern Pike Studies

Cooperator: Richard D. Peckham

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ABSTRACT

An estimate of the northern pike, *Esox lucius* Linnaeus, population abundance in Volkmar Lake was made in 1985. The population estimate for pike having fork lengths greater than 450 mm was 4,020 fish, or 14.8 pike/hectare (6.0 pike/acre). This estimate represents the combined estimates for two size groups as follows: (1) 450-699 mm, 3,615 fish, or 13.3 pike/hectare (5.4 pike/acre) and (2) 700 millimeters and greater, 405 fish, or 1.5 pike/hectare (0.6 pike/acre). An estimate for pike less than 450 mm in fork length was not possible because of their low rate of capture with gill nets.

From 31 May to 19 June, the total catch for all gillnetting efforts was 1,398 northern pike; these fish were captured in 1,168 net hours: a catch rate of 1.20 fish/net hour. Summaries of daily catch rates, catch by mesh size, and the length frequency, and length-weight relationship of 1,168 pike are presented in this study.

Utilizing cleithra bones for age determination, the age-length relationship for 252 pike (age 0 to 19) is summarized. Sex-composition determination for 1,013 northern pike provided a female to male ratio of 1:1.11. Furthermore, the capture and sampling of juvenile northern pike in August is discussed.

KEY WORDS

Volkmar Lake, northern pike, population estimates, age and growth, length frequency, gill netting, tagging.

BACKGROUND

The popularity of northern pike, *Esox lucius* Linnaeus, as a sport fish in Alaska has increased in recent years. Next to the Arctic grayling,

Thymallus arcticus Pallas, the northern pike is the most sought-after indigenous sport fish species in interior Alaska. From 1977 to 1984 the estimated annual statewide harvest of northern pike increased from 11,982 to 18,641, reaching a high of 21,476 in 1983 (Mills 1985). The Arctic-Yukon-Kuskokwim (A-Y-K) Region accounted for 76% of the estimated harvest of northern pike in 1984 and 90% for 1977-1984. Waters in the Tanana River drainage are the most accessible in the A-Y-K Region and have provided 64% of the regional harvest for the same 8-year period. Three of the most popular sport-fishing waters in the region are George and Volkmar Lakes and Minto Flats.

Population statistics needed to define a sustained yield of northern pike have not been developed, and the data base needed to develop such statistics is largely unavailable in Alaska waters.

Volkmar Lake was selected for study in 1985 because of its moderate size (273 hectares or 675 acres) and growing popularity, particularly for winter northern pike fishing. Several factors are responsible for the increased use of Volkmar Lake, including recent state land disposals on the lake, improved winter access from new roads (Delta Agricultural Project), and increased use by cabin owners on the Goodpaster River. Further increases in use and northern pike harvests are anticipated on Volkmar Lake and other waters as a result of development and population growth, largely due to expected increases in military personnel in the Fairbanks and Delta areas.

Volkmar Lake has two small inlets. The outlet is not well defined; it drains into the flats toward the Goodpaster River (west). Maximal depth is 12.8 m (42 ft). An accurate bathymetric map of Volkmar Lake is planned for inclusion in next year's annual report. Water chemistry is as follows: pH = 7.5; total alkalinity = 86 ppm, and total hardness = 103 ppm. The lake is usually ice-free from late May to early October. Other fish species present include humpback whitefish, least cisco, and slimy sculpin. Table 1 lists common names, scientific names, and abbreviations for fish referenced in this report.

In 1985 there were at least 26 property owners, 32 remote parcels that had been filed on, and 12 private cabins on the lake. Access during the summer is limited to float planes. The locations of waters in the Delta district are shown in Figure 1.

RECOMMENDATIONS

Research

1. Obtain estimates of northern pike population abundance in Volkmar and "T" Lakes in early spring 1986 using refined techniques and further evaluate gill-net selectivity.

2. Index population abundance in George Lake and other selected waters as time permits.

Table 1. List of common names, scientific names, and abbreviations.

Common Name	Scientific Name and Author	Abbreviation
Arctic grayling	*Thymallus arcticus* (Pallas)	GR
Humpback whitefish	*Coregonus pidschian* (Gmelin)	HWF
Least cisco	*Coregonus sardinella* (Valenciennes)	LCI
Northern pike	*Esox lucius* Linnaeus	NP
Slimy sculpin	*Cottus cognatus* Richardson	SSC

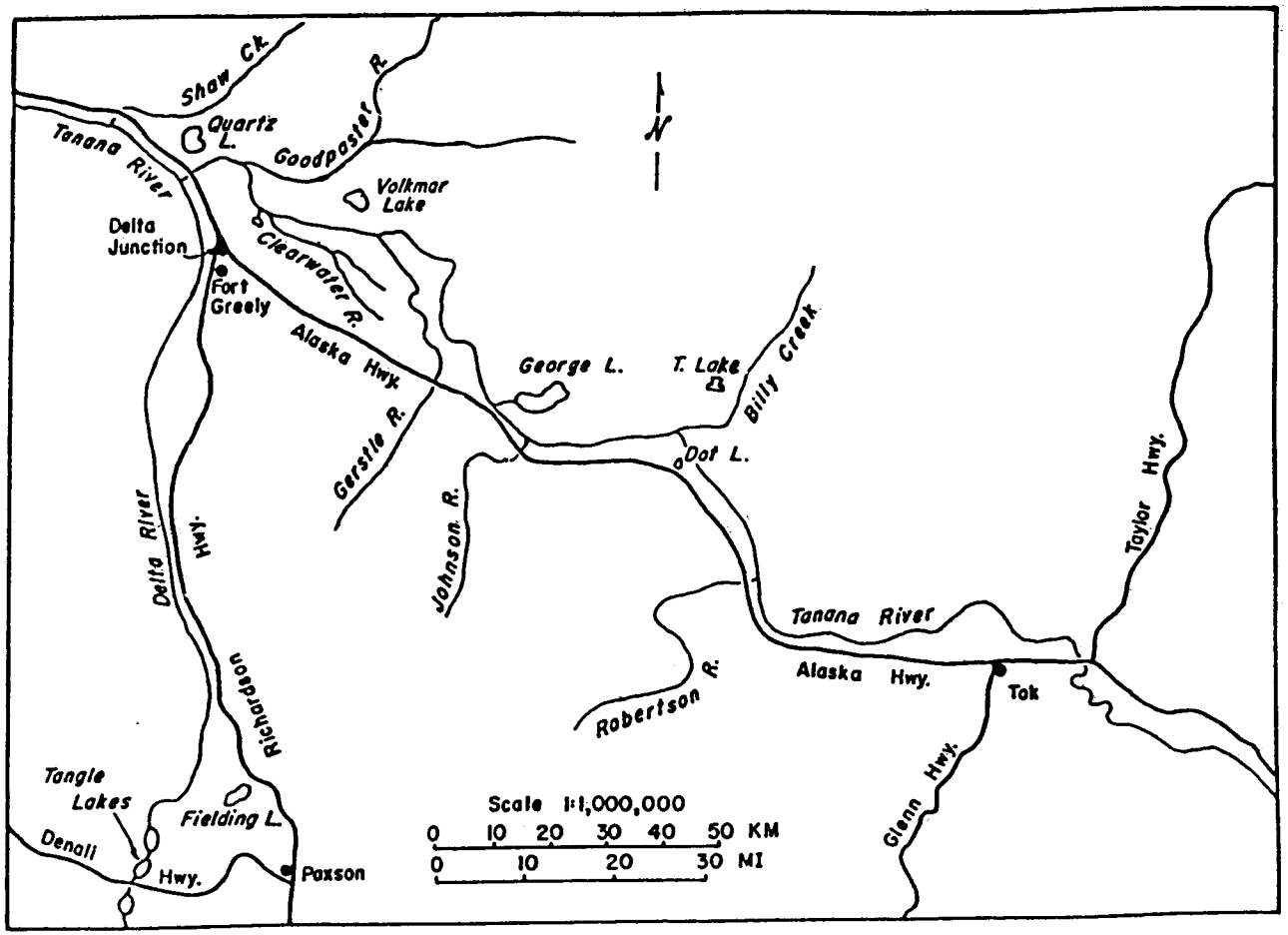

Figure 1. Location of waters in the Delta district.

3. Estimate the relationship between indices of abundance and actual population size in Volkmar and "T" Lakes and apply that relationship to waters that are indexed.

4. In conjunction with population-dynamics studies, assess alternate capture gear in some lakes: principally seines and fyke or trap nets fished using various methods, locations, and times of the year.

5. Plan and conduct an intensive summer creel census on George Lake in 1987 to determine total northern pike harvest, size and age composition of the catch, and total effort.

Management

1. Monitor winter fishing on Volkmar Lake to obtain information on effort, harvest, method of take (hook-and-line or spear) and obtain samples from tagged and untagged northern pike for age and growth determinations.

2. Obtain depth soundings, prepare bathymetric maps, and conduct general surveys on selected northern pike lakes where information is lacking, in preparation for future research efforts.

OBJECTIVES

1. To estimate (90% CI ± 25%) population abundance of northern pike in Volkmar Lake and develop a data base for scientific management of the recreational fishery.

2. To estimate size, sex and age composition of northern pike in Volkmar Lake based upon a sample size of at least 300 individuals.

3. To estimate (90% CI ± 25%) CPUE of juvenile northern pike (ages 0 and 1) and establish an index for annual comparison of recruitment strength.

TECHNIQUES USED

Most of the adult northern pike were captured with graduated-mesh multifilament floating gill nets (125 x 6 ft) having five mesh sizes (bar measure): 1, 1½, 2, 2½, and 3 inches. The nets were usually set perpendicular to the shoreline and near shore or at the outer fringes of emergent vegetation. Graduated mesh monofilament sinking gill nets (125 x 6 ft) having five mesh sizes ranging from ½ to 2½ in were utilized to sample deep-water areas of the lake.

Juvenile northern pike were captured primarily with a 50- x 5-ft bag seine having a ¼-in mesh. The seine was pulled by hand at selected locations along the shoreline. Other experimental gear included one 3/8-in-mesh fyke net with 50- x 4-ft lead, two 3/8-in-mesh hoop nets

with 50- x 4-ft lead, and two monofilament gill nets (50 x 6 ft): one having 3/8-in mesh and the other 3/4-in mesh.

Population estimates were determined by the Chapman modification of the Petersen estimate described by Ricker (1975).

Fork lengths of fish were measured to the nearest millimeter. Juvenile northern pike were weighed to the nearest 0.1 g on a triple-beam balance. Larger pike were weighed to the nearest 10 g on a Chatillon IN-6 or IN-25 spring scale. Condition factors were determined by the formula $K = W \div L^3 \times 10^5$, where K = condition factor, W = weight in g, and L = length in mm. Fish were tagged with Floy FD-68 anchor tags.

Cleithra bones were boiled to remove flesh, stored dry until aged, then wetted in loess solution (51% alcohol, 42% water and 7% glycerine), and viewed with a binocular microscope.

FINDINGS

Population Abundance and Biomass

The first time in Alaska that an estimate was made of a northern pike population in a lake occurred in 1985 at Volkmar Lake. From 31 May to 6 June, three two-man crews fished floating gill nets continuously during daylight hours. The length of time between lifts ranged from 0.25 to 3.90 hours, averaging 1.62 hours for 515 total lifts. Fish were carefully removed, a Floy tag was inserted at the base of the dorsal fin, and the right-pelvic fin was partially clipped to determine rate of tag loss during future sampling. The fish were measured, weighed, and released.

The lake was divided into three sections of nearly equal size to help assure uniform coverage of the entire shoreline. Ten days were allowed between the marking and recapture effort. From 17-19 June two crews again fished the lake with floating and sinking gill nets. During the recapture effort, most of the nets were again monitored continuously, but several of the nets were fished unattended overnight to allow larger sample size with the limited manpower.

The population estimate for pike having fork lengths greater than 450 mm is 4,020 fish (90% CI ± 10%), or 14.8 pike/hectare (6.0 pike/acre). To provide greater accuracy, the total estimate represents a combined estimate for two size groups as follows: (1) 450-699 mm, n = 3,615, or 13.3 pike/hectare (5.4 pike/acre) and (2) 700 mm and greater, n = 405, or 1.5 pike/hectare (0.6 pike/acre) (Table 2). Due to size selectivity of the gear capturing larger fish, the 1985 estimate probably underestimates the actual population size. A method to reduce this bias statistically is being developed, and a more refined and accurate estimate will be provided in the annual report next year.

Table 3 illustrates the higher recapture to mark ratio for larger fish.

Table 2. Northern pike population estimates, Volkmar Lake, 1985.

Length Group (mm)	Number Marked	Number Examined	Recaptures	Petersen Estimate	90% Confidence Limits
< 450	89	31	0	...	...
450-699	722	204	40	3,615	3,205-4,205
> 700	179	62	27	405	359-451
> 450				4,020	3,607-4,443

Table 3. Northern pike recapture (R) to mark (M) ratios for the marking run, Volkmar Lake, 1985.

Fork Length (mm)	R/M x 100
STRATUM I	
450 - 499	5.4
500 - 549	4.5
550 - 599	6.3
600 - 649	6.8
650 - 699	10.0
STRATUM II	
700 - 749	17.5
750 - 799	13.5
800 - 849	19.0
850 - 899	38.0
900 - 949	21.4
950 - 999	16.7

Using weighted mean weights based on the size distribution of the fish handled within each size range, the estimated biomass of pike having 450 mm and greater fork length is 26.67 kg/hectare (23.79 lb/acre). Pike 450-699 mm in length and having a mean weight of 1.52 kg (3.34 lbs) represents 20.22 kg/hectare (18.04 lb/acre), while pike greater than 700 mm and having a mean weight of 4.35 kg (9.59 lb) accounts for 6.45 kg/hectare (5.75 lb/acre). Standing-crop and biomass estimates are summarized in Table 4; estimates for pike less than 450 mm were not possible because of their low rate of capture with gill nets. As shown in Table 2, only 89 pike of that size group were captured and marked; 31 were later examined for marks; however, none were recaptured.

Catch Rates

Capture rates of northern pike in experimental gill nets in Volkmar Lake for the period 31 May to 6 June and 17 to 19 June are summarized in Table 5. Three types of gill-net sets were made:

1. Sinking gill nets monitored continuously during daylight hours;

2. Floating gill nets monitored continuously during daylight hours; and

3. Floating gill nets fished overnight.

Overnight sets were made only from 17 to 19 June in an effort to maximize catches with limited manpower.

From 31 May to 6 June, the capture rate for sinking gill nets was slightly higher than for floating gill nets, 1.40 and 1.30 fish/net hour, respectively. However, total effort with floating gill nets was more than six times greater. From 17 to 19 June, the reverse was true; floating gill nets had a higher catch rate of 1.32 fish/net hour, compared to 1.00 fish/net hour for sinking nets. Total efforts with floating and sinking nets for that period were nearly equal.

Several floating gill nets fished overnight during the 17 to 19 June period had a higher total catch (Table 5), but fish/net hour was much lower at 0.67.

The catch rate for sinking gill nets from 31 May to 6 June was 1.40 fish/net hour, compared to 1.00 fish/net hour from 17 to 19 June. The reverse might be expected, since sinking gill nets were fished offshore in deeper water. During the earlier period, water temperatures were cooler, and many pike were just completing spawning. In the latter period, spawning had been completed, water temperatures were warmer 13°-16°C (56°-60°F), and in contrast to early June, few pike were observed in shallow shoreline areas. The daytime catch rates for floating gill nets were nearly the same in early June (1.30 fish/

Table 4. Standing crop and biomass of northern pike in Volkmar Lake, 1985.

	Fork Length		
	450-699 mm	≥ 700 mm	All pike ≥ 450 mm
No./hectare	13.3	1.5	14.8
No./acre	5.4	0.6	6.0
Mean weight:			
kg	1.52	4.35	...
lbs	3.34	9.59	...
kg/hectare	20.22	6.45	26.67
95% CI	19.85 - 20.64	6.21 - 6.68	26.06 - 27.32
lbs/acre	18.04	5.75	23.79
95% CI	17.71 - 18.41	5.54 - 5.96	23.25 - 24.37

Table 5. Capture rate of northern pike in graduated-mesh gill nets, Volkmar Lake, 1985.

Date	Sinking Gill Nets			Floating Gill Nets			Combined Total		
	Total Net Hrs.	Total Fish	CPUE*	Total Net Hrs.	Total Fish	CPUE	Total Net Hrs.	Total Fish	CPUE**
31/5	2.25	3	1.33	45.75	94	2.05	48	97	2.02
1/6	7.75	2	0.26	106.25	82	0.77	114	84	0.74
2/6	20.15	25	1.23	127.75	122	0.95	148	147	0.99
3/6	21.16	30	1.42	119.84	186	1.55	141	216	1.53
4/6	22.75	29	1.27	105.25	187	1.78	133	216	1.62
5/6	26.50	41	1.55	135.50	211	1.56	162	252	1.56
6/6	7.50	21	2.80	82.50	67	0.81	90	88	0.98
31/5-6/6	108.16	151	1.40	727.84	949	1.30	836	1,100	1.32
17/6	12.25	17	1.39	38.75	26	0.67	51	43	0.84
18/6	50.00	41	0.82	24.25	41	1.69	74	82	1.11
				(94.75)**	(51)	(0.54)			
19/6	21.80	25	1.15	12.20	32	2.62	34	57	1.68
				(78.00)	(65)	(0.83)			
17/6-19/6	84.05	83	1.00	75.20	99	1.32	159	182	1.14
				(172.75)	(116)	(0.67)			
31/5-19/6	192.21	234	1.22	803.04	1,048	1.31	995	1,281	1.29
				(172.75)	(116)	(0.67)			

* CPUE = catch per unit of effort or fish/net hour.

** Data in parentheses represent overnight sets and are not included in the combined total.

net hour) as they were in the mid-June sampling (1.32 fish/net hour). The combined total catch rate for the entire sampling period (excluding the overnight sets) was 1.29 fish/net hour. In 1,168 total net hours, the total catch for all gill netting efforts was 1,398 northern pike: a catch rate of 1.20 fish/net hour.

Catch by Mesh Size

The most efficient mesh size (bar measure) for capturing northern pike in Volkmar Lake was 1½ in. Of a total sample of 972 pike, 606 (62.4%) were captured in 1½-in mesh, 217 (22.3%) in 2-in mesh, 100 (10.3%) in 1-in mesh, 40 (4.1%) in 2½-in mesh, and 9 (0.9%) in 3-in mesh (Table 6). The size ranges for pike captured in 1-, 1½-, 2-, 2½-, and 3-in mesh were 255-885 mm, 260-950 mm, 325-990 mm, 566-985 mm, and 739-930 mm, respectively.

Length Frequency

The length frequency of 1,168 northern pike sampled in Volkmar Lake in 1985 is presented in Table 7. The sample represents fish captured by gill net from 31 May to 19 June and does not include juvenile pike sampled in August. The most abundant size group was fish from 550-599 mm, comprising 26.3% of the total sample. Fish in the 200-449 mm, 450-699 mm, and 700 mm and larger-size groups comprised 9.2%, 72.5%, and 18.3% of the total sample, respectively.

Age and Growth

A total of 252 pike was sampled for age determination in 1985. A summary of the age-length relationship is presented in Table 8. Most of the sample (n = 167) was comprised of gill-netting mortalities (31 May-19 June 1985) representing ages 2 to 19. All age-0 and all but two age-2 pike were captured in August using either a bag seine, hoop nets, or fyke nets. The data are not necessarily representative of age-class abundance.

Age class 5 was the most prevalent in the sample, comprising 18.7% of the total. They ranged from 457-626 mm in length, with a mean of 543 mm. Age-0 pike sampled in mid August had a length range of 82-138 mm, with a mean of 106 mm. The oldest pike captured was age 19 and 912 mm in length.

Length-Weight Relationship

The length-weight relationship for pike (sexes combined) sampled from Volkmar Lake is shown in Figure 2. The length-weight relationship for males and females was essentially the same; thus it was combined. Length measurements and weights were taken primarily from post-spawning fish from 31 May-19 June and represent 549 males and 484 females.

Table 6. Catch by mesh size of northern pike, Volkmar Lake, 1985.

	Mesh Size (inches)					Total
	1.0	1.5	2.0	2.5	3.0	
Catch	100.0	606.0	217.0	40.0	9.0	972
Percent	10.3	62.4	22.3	4.1	0.9	
Mean Length (mm)	509.0	575.0	667.0	806.0	850.0	
SD (mm)*	149.0	99.0	121.0	108.0	50.0	
SE (mm)**	15.0	4.0	8.0	17.0	17.0	
Min (mm)	255.0	260.0	325.0	566.0	739.0	
Max (mm)	885.0	950.0	990.0	985.0	930.0	
90% From	484.0	568.0	653.0	777.0	822.0	
To	533.0	581.0	680.0	834.0	878.0	
±2 x SD From	211.0	377.0	424.0	589.0	750.0	
To	806.0	772.0	909.0	1022.0	950.0	
Rel. Eff.***	0.17	1.00	0.36	0.07	0.01	

* SD = Standard deviation
** SE = Standard error
*** Rel. Eff. = Relative efficiency

Table 7. Length-frequency distribution of 1,168 northern pike captured in Volkmar Lake, 1985.

Length Range (mm)	No.	Percent
200-249	1	0.1
250-299	8	0.7
300-349	16	1.4
350-399	30	2.6
400-449	52	4.4
450-499	110	9.4
500-549	204	17.5
550-599	307	26.3
600-649	153	13.1
650-699	73	6.3
700-749	69	5.9
750-799	41	3.5
800-849	46	3.9
850-899	40	3.4
900-949	13	1.1
950-999	5	0.4
200-999	1,168	100.0

Table 8. Age-length relationship of northern pike, Volkmar Lake, 1985.

Age Class	No.	%	Length (mm) Mean	Min	Max	SD	CI*
0	34	13.5	106	82	138	15	4
1	6	2.4	183	160	217	24	20
2	17	6.7	290	244	353	26	11
3	20	7.9	329	238	398	40	16
4	21	8.3	471	366	548	44	17
5	47	18.7	543	457	626	44	11
6	19	7.5	556	464	626	42	17
7	19	7.5	598	473	700	53	21
8	14	5.6	626	540	742	63	30
9	18	7.1	698	576	830	76	31
10	17	6.7	751	605	866	78	33
11	11	4.4	806	720	865	51	28
12	6	2.4	792	654	955	103	82
13	1	0.4	716				
14	1	0.4	920				
19	1	0.4	912				
Totals	252	100.0	491	82	955	219	23

Mean Age = 8.3

* .10

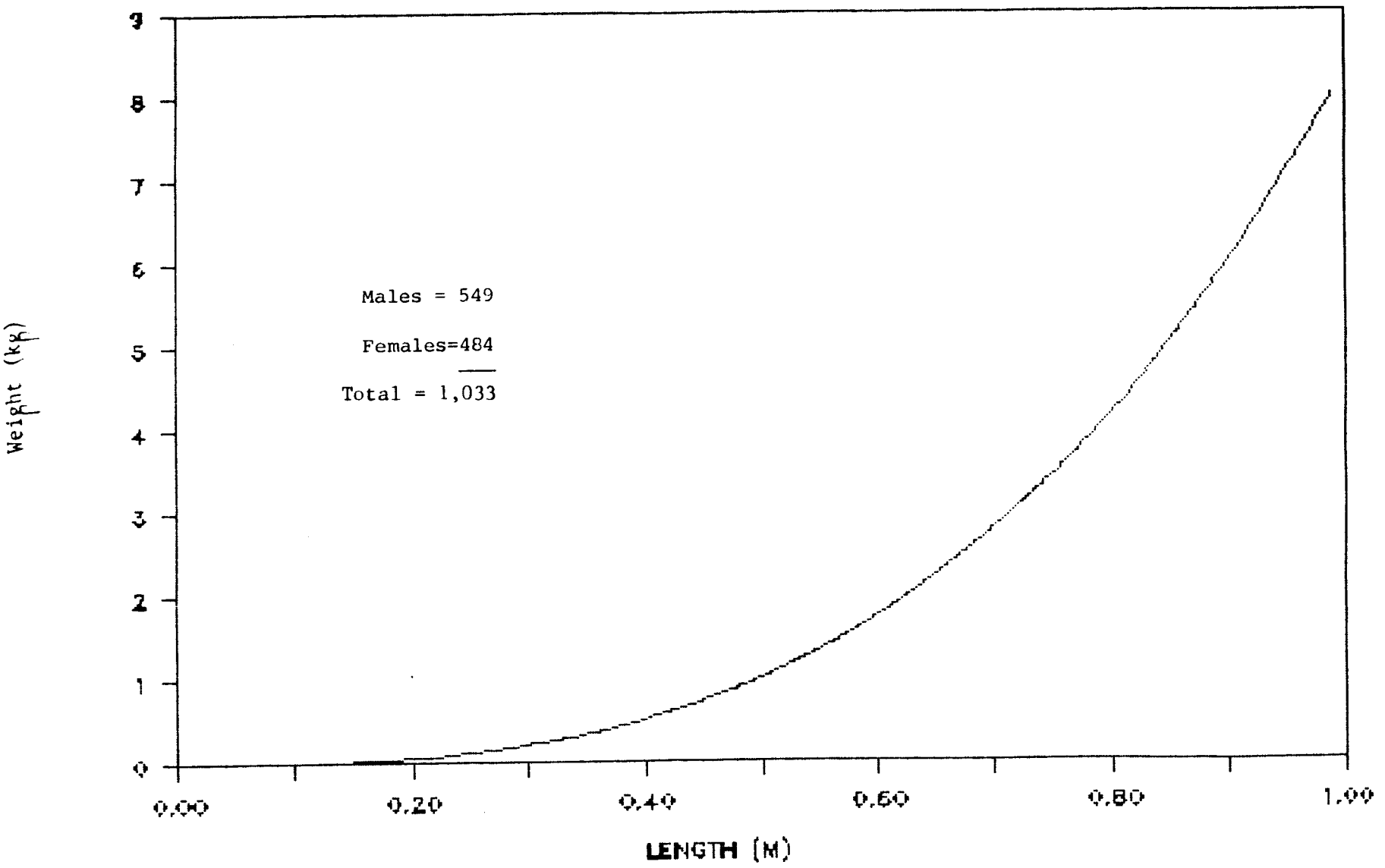

Figure 2. Length/weight relationship of northern pike, Volkmar Lake, 1985.

Sex Composition

Sex composition was determined for a total of 1,013 northern pike netted between 31 May and 19 June 1985. Of the total, 479 were females and 534 were males: a female-to-male ratio of 1:1.11 (Table 9). Males outnumbered females in the samples on 7 of the 10 days.

Although spawning was nearly complete at the time of netting (31 May and 6 June) sex products could still be stripped from most males and some females. For fish for which sex could not be determined by stripping, external sex determination was made by methods described by Casselman (1974).

Sex determinations for nearly all pike netted from 17 to 19 June were made from autopsied fish that were netting mortalities.

Juvenile Northern Pike Sampling

Juvenile northern pike sampling was conducted from 12 to 14 August, using a bag seine, fyke nets, hoop nets with leads, and small-mesh gill nets. The bag seine was by far the most efficient gear type; 52 age-0, 6 age-1, 14 age-2 and 10 age-3 and older northern pike in 23 hauls, for mean catch rates of 2.3, 0.3, and 0.6 and 0.4 fish/net hour, respectively (Table 10). The seine hauls averaged approximately 100 ft in length. Most of the shoreline suitable for seining with chest waders was sampled.

Seventy to 100 seine hauls were needed to estimate (90% CI ± 25%) CPUE of juvenile northern pike, according to statistical procedures described by Snedecor and Cochran (1980).

In 89 hours, hoop-net and fyke-net sets captured only two age-0, one age-2, and one age-7 northern pike. Small-mesh gill nets set for 44.5 net hours captured only one age-0 and three age-2 northern pike.

The mean condition factors for samples of age-0, age-1, and age-2 northern pike are presented in Table 11.

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Table 9. Daily catches of male and female northern pike, Volkmar Lake, 1985.

Date	Male			Female			Ratio of Females to Males	Total Fish
	No. of Fish	Percent		No. of Fish	Percent			
		Daily	Cumulative		Daily	Cumulative		
31/5	59	11.1	11.1	30	6.3	6.3	1:1.97	89
1/6	34	6.3	17.4	43	9.0	15.3	1:0.79	77
2/6	71	13.3	30.7	67	14.0	29.3	1:1.06	138
3/6	80	15.0	45.7	96	20.0	49.3	1:0.83	176
4/6	88	16.5	62.2	75	15.7	65.0	1:1.17	163
5/6	69	12.9	75.1	56	11.7	76.7	1:1.23	125
6/6	37	6.9	82.0	13	2.7	79.4	1:2.85	50
7/6	14	2.6	84.6	5	1.0	80.4	1:2.80	19
18/6	57	10.7	95.3	72	15.0	95.4	1:0.79	129
19/6	25	4.7	100.0	22	4.6	100.0	1:1.14	47
	534			479			1:1.11	1,013

Table 10. Summary of juvenile northern pike catches by bag seine, Volkmar Lake, 13 and 14 August 1985.

Haul No.	Number of Northern Pike Captured				Total
	Age 0	Age 1	Age 2	≥ Age 3	
1	14	...	...	...	14
2	4	...	1	...	5
3	2	...	...	...	2
4	3	...	...	1	4
5	...	1	1	...	2
6	4	1	2	...	7
7	3	3	3	2	11
8	...	...	1	1	2
9	2	...	1	...	3
10	7	...	...	1	8
11	3	...	1	...	4
12	1	...	...	...	1
13	1	...	...	...	1
14	3	...	2	1	6
15	...	...	...	...	0
16	2	...	...	...	2
17	1	...	...	...	1
18	1	...	...	1	2
19	...	...	...	...	0
20	...	...	...	...	0
21	1	...	1	...	2
22	...	...	...	...	0
23	...	1	2	3	6
Total Catch	52	6	14	10	82
Mean Catch	2.3	0.3	0.6	0.4	

Table 11. Mean condition factors* for northern pike, ages 0 to 2, Volkmar Lake, August 1985.

Age Class	Number	Mean	Variance	Standard Deviation
0	59	0.80	0.0093	0.0963
1	6	0.77	0.0020	0.0446
2	14	0.73	0.0013	0.0367

* Condition factor = $K = W \div L^3 \times 10^5$

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